CLAIMS

1. A wireless receiver for receiving signals from a transmitter, the transmitter comprising a plurality of transmit antennas for transmitting the signals which comprise respective streams of independent symbols and wherein interference occurs between the respective streams, the receiver comprising:

a plurality of receive antennas for receiving the signals as influenced by a channel effect between the receiver and the transmitter;

circuitry for multiplying the signals times a conjugate transpose of an estimate of the channel effect and times a conjugate transpose of a linear basis transformation matrix;

circuitry for selecting the linear basis transformation matrix from a finite set of linear basis transformation matrices; and

circuitry for removing the interference between the respective streams.

2. The receiver of claim 1 and further comprising circuitry for determining the estimate of the channel effect, and wherein the circuitry for selecting selects the linear basis transformation matrix in response to the estimate of the channel effect.

3. The receiver of claim 1 wherein the circuitry for selecting comprises:

circuitry for determining a signal-to-interference-noise ratio corresponding to each matrix in the finite set and to each of the streams; and

circuitry for selecting the linear basis transformation matrix as corresponding to an optimum determined signal-to-interference-noise ratios.

4. The receiver of claim 3 wherein each signal-to-interference-noise ratio is determined in response to the estimate of the channel effect.

5. The receiver of claim 3 wherein the circuitry for removing the interference between the respective streams is selected from a group consisting of circuitry for zero forcing and circuitry for determining a minimum mean square error.

6. The receiver of claim 5 wherein the circuitry for removing the interference between the respective streams is selected from a group consisting of iterative and linear.

7. The receiver of claim 3 wherein the circuitry for removing the interference between the respective streams comprises maximum likelihood detection circuitry.

8. The receiver of claim 3 wherein the circuitry for selecting comprises circuitry for identifying a minimum of the signal-to-interference-noise ratios corresponding to each matrix in the finite set, and wherein the circuitry for selecting selects the linear basis transformation matrix as corresponding to a maximum of the identified minimums.

9. The receiver of claim 3 wherein the circuitry for selecting comprises circuitry for minimizing a mean square error of the signal-to-interference-noise ratios corresponding to each matrix in the finite set.

10. The receiver of claim 1 and further comprising circuitry for communicating an identification of the linear basis transformation matrix to the transmitter via a feedback channel.

11. The receiver of claim 10:

wherein the finite set consists of a number N matrices; and

wherein the circuitry for communicating is operable to communicate the linear basis transformation matrix to the transmitter via a feedback channel by transmitting a number of bits equal to $\log_2(N)$ bits to the transmitter.

12. The receiver of claim 11 wherein N is less than or equal to 16.

13. The receiver of claim 1 wherein each matrix in the finite set of linear basis transformation matrices is operable for performing a rotation by the transmitter of the symbols.

14. The receiver of claim 1 wherein each matrix in the finite set of linear basis transformation matrices is operable for performing a rotation and phase change by the transmitter of the symbols.

15. The receiver of claim 1 wherein each matrix in the finite set of linear basis transformation matrices comprises a form of $\mathbf{V}^{(n)} = \begin{bmatrix} \cos\theta_n & -\sin\theta_n \\ \sin\theta_n & \cos\theta_n \end{bmatrix}$.

16. The receiver of claim 1 wherein each matrix in the finite set of linear basis transformation matrices comprises a form of $\mathbf{V}^{(n)} = \begin{bmatrix} \cos\theta_n e^{j\phi_m} & -\sin\theta_n e^{j\phi_m} \\ \sin\theta_n & \cos\theta_n \end{bmatrix}$.

17. The receiver of claim 1 wherein each matrix in the finite set of linear basis transformation matrices comprises a permutation of a first matrix.

18. The receiver of claim 17 wherein the first matrix comprises an identity matrix.

19. The receiver of claim 1 wherein the circuitry for multiplying comprises space time block coded decoding circuitry.

20. The receiver of claim 1 wherein the circuitry for selecting comprises:

circuitry for determining a signal-to-noise ratio corresponding to each matrix in the finite set and to each of the streams; and

circuitry for selecting the linear basis transformation matrix as corresponding to an optimum determined signal-to-noise ratio.

21. The receiver of claim 1 and further comprising circuitry for determining the estimate of the channel effect in response to pilot symbols received from the transmitter.

22. The receiver of claim 1 wherein the circuitry for removing the interference between the respective streams is selected from a group consisting of circuitry for zero forcing, circuitry for determining a minimum mean square error, and circuitry for determining a maximum likelihood.

23. The receiver of claim 1 wherein the signals comprise CDMA signals and further comprising circuitry for despreading the CDMA signals.

24. The receiver of claim 1 wherein the signals comprise TDMA signals.

25. The receiver of claim 1 wherein the symbols are selected from a group consisting of quadrature phase shift keying symbols, binary phase shift keying symbols, and quadrature amplitude modulation symbols.

26. The receiver of claim 1 wherein the circuitry for multiplying the signals times a conjugate transpose of an estimate of the channel effect comprises a space time block coded transmit antenna diversity decoder.

27. The receiver of claim 1 wherein the plurality of transmit antennas and the plurality of receive antennas are a same number of antennas.

28. The receiver of claim 27 wherein the same number equals two.

29. The receiver of claim 1 wherein the plurality of transmit antennas are less in number than the plurality of receive antennas.

30. The receiver of claim 1 and further comprising:
a demodulator coupled to receive an output from the circuitry for multiplying;
a deinterleaver coupled to receive an output of the demodulator; and
a decoder coupled to receive an output of the deinterleaver.

31. A wireless communication system, comprising:

a transmitter comprising a plurality of transmit antennas for transmitting signals which comprise respective streams of independent symbols and wherein interference occurs between the respective streams; and

a receiver for receiving signals from a transmitter, the transmitter comprising a plurality of transmit antennas for transmitting the signals which comprise respective streams of independent symbols and wherein interference occurs between the respective streams, the receiver comprising:

a plurality of receive antennas for receiving the signals as influenced by a channel effect between the receiver and the transmitter;

circuitry for multiplying the signals times a conjugate transpose of an estimate of the channel effect and times a conjugate transpose of a linear basis transformation matrix;

circuitry for selecting the linear basis transformation matrix from a finite set of linear basis transformation matrices; and

circuitry for removing the interference between the respective streams.

32. The system of claim 31 wherein the receiver further comprises circuitry for determining the estimate of the channel effect, and wherein the circuitry for selecting selects the linear basis transformation matrix in response to the estimate of the channel effect.

33. The system of claim 31 wherein the receiver further comprises:

circuitry for determining a signal-to-interference-noise ratio corresponding to each matrix in the finite set and to each of the streams; and

circuitry for selecting the linear basis transformation matrix as corresponding to an optimum determined signal-to-interference-noise ratios.

34. The system of claim 31 wherein each matrix in the finite set of linear basis transformation matrices is operable for performing a rotation by the transmitter of the symbols.

35. The system of claim 31 wherein each matrix in the finite set of linear basis transformation matrices is operable for performing a rotation and phase change by the transmitter of the symbols.

36. The receiver of claim 31 wherein each matrix in the finite set of linear basis transformation matrices comprises a permutation of a first matrix.

37. The system of claim 31 wherein the receiver further comprises circuitry for communicating an identification of the linear basis transformation matrix to the transmitter via a feedback channel.

38. The system of claim 37 wherein the transmitter further comprises circuitry for multiplying the respective streams of independent symbols times the identified linear basis transformation matrix.

39. A method of operating a wireless receiver, comprising:

receiving signals at a plurality of receive antennas and transmitted from a transmitter, the transmitter comprising a plurality of transmit antennas for transmitting the signals which comprise respective streams of independent symbols and wherein interference occurs between the respective streams and wherein the received signals are influenced by a channel effect between the receiver and the transmitter;

multiplying the signals times a conjugate transpose of an estimate of the channel effect and times a conjugate transpose of a linear basis transformation matrix;

selecting the linear basis transformation matrix from a finite set of linear basis transformation matrices; and

removing the interference between the respective streams.

40. The method of claim 39 and further comprising determining the estimate of the channel effect, and wherein the step of selecting selects the linear basis transformation matrix in response to the estimate of the channel effect.

41. The method of claim 39 wherein the step of selecting comprises:

determining a signal-to-interference-noise ratio corresponding to each matrix in the finite set and to each of the streams; and

selecting the linear basis transformation matrix as corresponding to an optimum determined signal-to-interference-noise ratios.

42. A wireless transmitter for transmitting signals to a receiver, comprising:

a plurality of transmit antennas for transmitting the signals, the signals comprising respective streams of independent symbols and wherein interference occurs between the respective streams;

circuitry for multiplying symbols times a linear basis transformation matrix, wherein the signals are responsive to the multiplication times a linear basis transformation matrix; and

circuitry for selecting the linear basis transformation matrix in response to a communication received by the transmitter from the receiver via a feedback channel.

43. The wireless transmitter of claim 42 wherein the receiver comprises:

circuitry for selecting the linear basis transformation matrix; and

circuitry for providing the communication to the transmitter via the feedback channel.

44. The wireless transmitter of claim 43 wherein the circuitry for selecting the linear basis transformation matrix selects from a finite set of linear basis transformation matrices.

45. The wireless transmitter of claim 44:

wherein the finite set consists of a number N matrices; and

wherein the communication consists of a number of bits equal to $\log_2(N)$ bits to the transmitter.

46. The wireless transmitter of claim 45 wherein N is less than or equal to 16.

47. The wireless transmitter of claim 42 wherein the linear basis transformation matrix is operable for performing a rotation by the transmitter of the symbols.

48. The wireless transmitter of claim 42 wherein the linear basis transformation matrix is operable for performing a rotation and phase change of the symbols.

49. The wireless transmitter of claim 42 wherein the linear basis transformation matrix comprises a form of $\mathbf{V}^{(n)} = \begin{bmatrix} \cos\theta_n & -\sin\theta_n \\ \sin\theta_n & \cos\theta_n \end{bmatrix}$.

50. The wireless transmitter of claim 42 wherein the linear basis transformation matrix comprises a form of $\mathbf{V}^{(n)} = \begin{bmatrix} \cos\theta_n e^{j\phi_m} & -\sin\theta_n e^{j\phi_m} \\ \sin\theta_n & \cos\theta_n \end{bmatrix}$.

51. The wireless transmitter of claim 42 wherein the linear basis transformation matrix comprises a permutation of a first matrix.

52. The wireless transmitter of claim 51 wherein the first matrix comprises an identity matrix.

53. The wireless transmitter of claim 42 and further comprising circuitry for space time block coded encoding the symbols.

54. The wireless transmitter of claim 42 wherein the signals comprise CDMA signals and further comprising circuitry for spreading the CDMA signals.

55. The wireless transmitter of claim 42 wherein the signals comprise TDMA signals.

56. The wireless transmitter of claim 42 wherein the symbols are selected from a group consisting of quadrature phase shift keying symbols, binary phase shift keying symbols, and quadrature amplitude modulation symbols.

57. The wireless transmitter of claim 42:

wherein the receiver comprises a plurality of receive antennas; and

wherein the plurality of transmit antennas and the plurality of receive antennas are a same number of antennas.

58. The wireless transmitter of claim 57 wherein the same number equals two.

59. The wireless transmitter of claim 57 wherein the plurality of transmit antennas are less in number than the plurality of receive antennas.

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